

**Experiment title:**

Energy disperse XAFS investigations of Rh and Pt catalysts for syngas synthesis

**Experiment****number:**

CH-286

**Beamline:**

ID 24

**Date of experiment:**

from: 22.01.1997 to: 27.01.1997

**Date of report:**

27.02.98

**Shifts:**

15

**Local contact(s):**

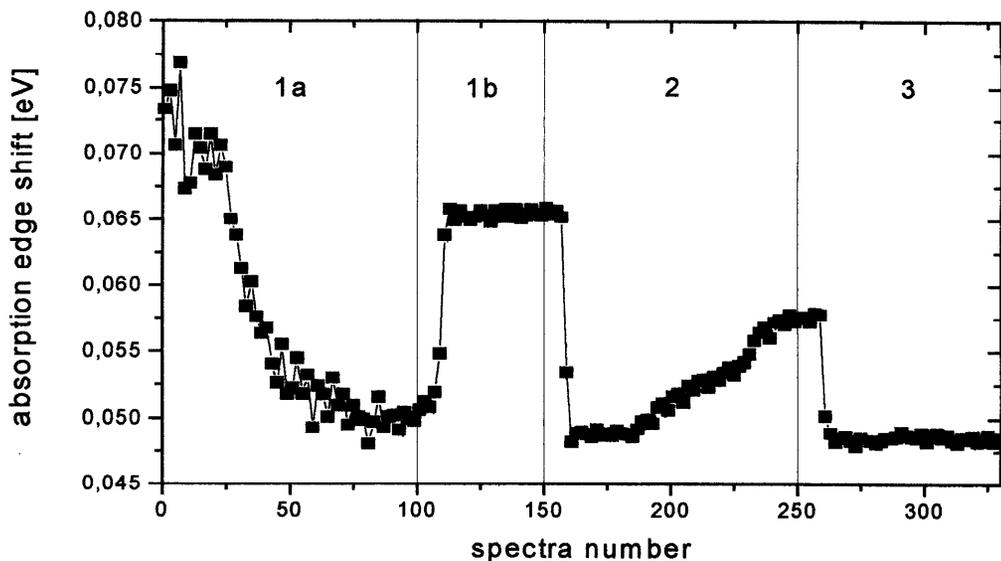
Dr. M. Hagelstein

*Received at ESRF:***-4** MAR. 1998**Names and affiliations of applicants** (\* indicates experimentahsts):Prof. Dr. U. Steinike Institut **für** Angewandte Chemie Berlin-Adlershof, Berlin, GermanyDr. P. Druska \* Institut **für** Angewandte Chemie Berlin-Adlershof, Berlin, GermanyDipl.-Krist. L. Wilde \* Institut **für** Angewandte Chemie Berlin-Adlershof, Berlin, Germany

□

## Report:

We have studied the mechanism of the syngas synthesis with methane and oxygen at rhodium and platinum catalysts as to structural aspects. Our first investigations engaged with the single reactions to be expected on the catalyst surfaces. Herewith we have exposed the 1% rhodium - aluminum oxide - catalyst and the 1% platinum - magnesium oxide - catalyst the individual gas components first. There we could compare the near edge structure of the different standard spectra with the spectras obtained by the treatment of the complete feed. In a second step the catalysts were exposed feed systems which contained different concentrations of the feed components. These treatments lead to a change in the surface behavior. Especially the formation of pure carbon on the surface was observed under very high methane concentrations. Figure 1 shows the shift the absorption edge at the different reaction steps of a platinum catalyst.



The cleaning of the platinum catalyst with hydrogen is to be observed in step 1a at 500 °C and after that the activation procedure with synthetic air (1b). As next step in figure 1 is shown the reactive phase 2 with a mixture from methane and synthetic air, which leads to carbon monoxide and hydrogen. **If the** concentration of methane is too high, a layer of pure carbon is build on the surface of the platinum which leads to a desactivation of the catalyst. This layer can be removed in a third step under carbon dioxide atmosphere which results to the balance of  $\text{CO}_2 + \text{C} \rightarrow 2 \text{CO}$ . A **free** platinum surface is build again shown by the edge structur of platinum metal, which edge position is close to the end of phase 1a. The catalytic circle can start again after activation by synthetic air.

Because of the slight concentration of platinum and rhodium in the catalysts it is **difficult**, to evaluate the full XAFS spectra on traditional way. Till now we work at a suitable evaluation of the measured DeXAFS spectra which could be lead to a exact structural information. Up to now it is to be said, that it is important to make further measurements of these catalysts with higher metal concentration to understand the structural mechanism exactly.